FY17 GRC: Shock/Corrosion Proof Bearings for Space Mechanisms

Completed Technology Project (2017 - 2022)

Project Introduction

Space mechanisms often present an unusual set of requirements for tribological components such as bearings. Highly corrosive, extreme temperature, dynamic loading, etc, environmental demands sometimes drive the choice of bearing design and/or material more so than the operational requirements. Frequently, no bearing material or technology exists to satisfy all of the unique requirements of a given space mechanism. The result is that one or more desired capabilities must be compromised (eg. life, power loss, speed). The vision of the proposed effort is to broaden the current capability of bearings through new materials and design practices to eliminate some of these compromises, enabling enhanced current and future mission prospects. A promising class of materials (Nickel Titanium (NiTi) alloys) have been shown to have significant potential for challenging bearing applications requiring high corrosion resistance and/or withstanding large shock loads in addition to the typical rigors of rotating machinery. The goal of this project is to demonstrate shock and corrosion resistant NiTi bearings to address limitations in current space mechanism bearing technology.

Anticipated Benefits

The NiTi alloys considered under this proposal are unique in the sense that they are highly corrosion resistant and have very high elastic strain limits, yet are also very hard. No other known bearing material exhibits this particular combination of properties that combine to offer superior bearing capabilities for highly corrosive applications and severe dynamics applications. In the 5 to 10 years following the successful completion of the proposed effort, retrofits of NiTi bearings into existing designs with tribology problems related to corrosion and high dynamic loads could provide mitigation for those problems, extending the life and/or performance of certain mechanisms. In the longer term, further out missions could benefit from engineering enhanced capabilities into mechanisms afforded by NiTi bearings. Mechanisms that were previously not possible could become possible through the new bearing capabilities.

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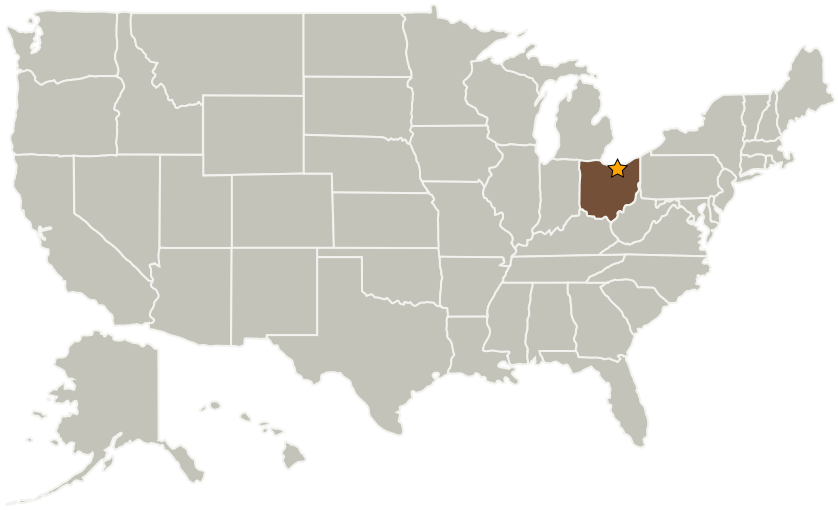
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Barden Corporation	Supporting Organization	Industry	Danbury, Connecticut
Napolean Engineering	Supporting Organization	Industry	Olean, New York

Primary U.S. Work Locations
Ohio

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Center Independent Research & Development: GRC IRAD

Project Management

Program Manager:

Gary A Horsham

Project Manager:

Samuel A Howard

Principal Investigator:

Samuel A Howard

Co-Investigator:

Malcolm K Stanford

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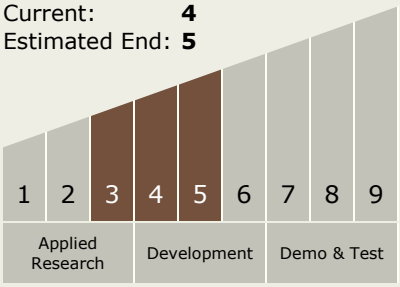
Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **5**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.6 Materials for Electrical Power Generation, Energy Storage, Power Distribution and Electrical Machines

Target Destinations

Earth, The Moon, Mars

Supported Mission Type

Push